

THE GENUS *TRACHELOMONAS*.

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(Plates i.-v.; and Text-figs. 1-20.)

Very little attention has been given to this interesting genus of freshwater flagellates. Senn, in his "Anhang zu den Flagellata" (Engler & Prantl, "Die Natürlichen Pflanzenfamilien, 1900) gives the number of species as six. Stein, however, in "Die Naturgeschichte der Flagellaten" (Abt. iii., H. i. of his "Organismus der Infusionsthier," 1878), had already figured 10 species. Half of these date back to Ehrenberg, viz., *Tr. volvocina*, *Tr. cylindrica*, *Tr. lagenella*, *Tr. armata*, and *Tr. caudata*, though often under other generic names. *Tr. hispida* Perty, *Tr. acuminata* Schmarða, *Tr. bulla* Stein, *Tr. rugulosa* Stein, and *Tr. eurystoma* Stein, make up the remainder. Kent, "Manual of the Infusoria," 1878, gives descriptions of those mentioned by Stein, but figures of five only. Stokes, "Freshwater Infusoria of the United States" (Journ. Trenton Nat. Hist. Soc., 1888), describes five other species, *Tr. verrucosa* Stokes, *Tr. acanthostoma* Stokes, *Tr. torta* Kellicott, *Tr. piscatoris* (Fisher) Stokes, and *Tr. urceolata* Stokes, with figures of the last three. In "Notices of New Freshwater Infusoria" (Amer. Phil. Soc., 1890), the same author proposed four other species, viz., *Tr. cervicula*, *Tr. similis*, *Tr. obovata*, *Tr. spinosa*. Other publications containing notices of new forms are: Klebs, "Organization einiger Flagellatengrupper" (Bot. Inst. zu Tübingen, 1881-85), *Tr. reticulata* Klebs; Dangeard, "Recherches sur les Eugléniens" (Botaniste, 1902), *Tr. intermedia* Dangeard, with notes and figures of *Tr. volvocina*, *Tr. rugulosa*, *Tr. lagenella*, *Tr. hispida*, *Tr. caudata*, *Tr. armata*, and *Tr.*

reticulata; Lemmermann, "Reise nach der Pacific" (Abh. Nat. Ver. Bremen, Bd. xvi., 1899), *Tr. oblonga*, n.sp.; Lemmermann, "von Dr. Volz gesammelten Süßwasseralgen" (*ibid.*, Bd. xviii., 1904), *Tr. Volzii*, n.sp., with observations on *Tr. volvocina*, *Tr. oblonga*, *Tr. euchlora* (*Tr. lagenella*), *Tr. hispida*, *Tr. armata*, and *Tr. bulla*, figures and descriptions of new forms; Bruno Schröder, "Alg. der Versuch. zu Trachenberg" (Plöner Berichte Th.v., 1897), figures of two variations of *Tr. hispida*; Maskell, "On Freshwater Infusoria" (Trans. New Zealand Inst., 1886), figure and description of *Tr. crenatocollis*, n.sp.; *ibid.*, 1887, *Tr. teres*, n.sp.

As I have not access to either Ehrenberg, "Die Infusoriens-thiere," 1838; Perty, "Kleinster Lebensformen in der Schweiz," 1852; or Schmarda, "Neue Formen von Infusorien," 1850, I have been obliged to accept Stein's excellent figures as typical of the seven species described in these memoirs. *Tr. armata*, however, is excepted, in whose case, Ehrenberg's original description is quoted by Lemmermann, *l.c.*, Bd. xviii., p.165. I know of no publications, other than the above, containing new forms of *Trachelomonas*.

These memoirs give a total of 25 published species of greater or less validity, and 8 variations, the majority of which are discussed in this paper, in addition to a large number of types and variations apparently never before noted. In many cases, unfortunately, the exact European type has not been observed by me, but only a very similar form, showing, however, the specific characteristics sufficiently well for identification. It is, indeed, through these "very similar forms" that what is truly characteristic and what is not, become most clearly discernible.

The present paper deals with forms of *Trachelomonas* found in New South Wales during the past seven years, and even then only in the two districts of Sydney and Lismore. Whatever may be the case in Europe, our waters here are very rich in forms of the genus, exhibiting a great variety of types. Ground-gatherings are best, out of swampy places, and especially out of shallow rainwater pools on grass-lands, the favourite haunt of green flagellates of all descriptions. Gatherings out of weeds are not, as a rule, so good.

LOCALITIES referred to in this paper; the numbers correspond to samples deposited in the National Herbarium, Sydney.

In the Sydney district.

Auburn 56, 135, 139, 148, swampy ground on railway opposite Ritchie's; 57, 68, pool in the angle of meat-works siding; 119, 120, 140, 163, swampy ground on railway towards Rookwood.

Botany 37, 92, water-reserve, weeds; 51, 152, ditto, ground-collection; 91, 151, swampy ground near tram-terminus; 108, 142, 145, Gardener's Road, swamps.

Botanic Gardens 3, 137, 150, gardeners' tank, weeds; 158, duck-pond, weeds.

Canley Vale 110, pool on railway towards Cabramatta, weeds.

Centennial Park 11, 133, weeds out of ponds.

Coogee 4, sphagnum-bog on cliffs, ground-collection.

Fairfield 79, swampy ground on railway towards Guildford; 143, weeds, Orphan School Creek.

Guildford 60, pool on railway, weeds; 45, 70, 77, 88, 146, ditto, ground; 76, 114, pool on railway nearer Merrylands, ground.

Parramatta Park 96, lake, weeds; 136, ditto, plankton; 165, 166, rainwater pools.

In the neighbourhood of Lismore.

Casino 189, weeds, Richmond River.

Kyogle 218, 219, lagoons, ground-collection.

Lismore 176, 183, 225, weeds, Richmond River; 240, swamp on railway towards Woodlawn; 241, lagoon behind Foley's; 236, 237, lagoon near North Lismore Station; 238, 254, lagoon on Goolmangar Road; 242, rainwater pools foot of Girard's Hill; 244, ditto, near Drill Hall; 245, 246, ditto, vacant ground in Conway Street.

SYDNEY GATHERINGS.—Out of 116 mixed gatherings, 40 contained species of *Trachelomonas* in some quantity, with a varying number of forms. Of these 40, 28 were off the ground, and only 12 out of weeds, to which must be added that, in the latter, the forms of *Trachelomonas* present were almost invariably very sparsely distributed. The larger number of samples contained from 1 to 5 forms, but a few were very rich, yielding 10, 11, 12,

14, 15, 21, and even 24 varieties. The last mentioned (151) was from a shallow, insignificant rainwater-pool on grass-land, and almost every one of the 24 varieties was in profusion.

LISMORE GATHERINGS.—Only 12 forms were noted in the Richmond River, out of 20 very rich squeezings from weeds, and of these 12, the larger number were out of one sample (225), and extremely scarce. Of 23 ground-gatherings, only 9 contained *Trachelomonas* in any quantity, but these were very fine. They were taken in the winter of 1914, from shallow rainwater-meres, and small pools on level grass-lands. One of them (237), besides 18 varieties of *Trachelomonas*, yielded *Euglena viridis*, *Eu. acus*, *Eu. pisciformis*, *Eu. deses*, *Eu. tripteris* and var., *Eu. oxyuris*, *Phacus pleuronectes*, *Ph. longicauda*, *Ph. pyrum*, *Ph. monilata* var. *suecica* Lemm., *Phacus*, sp.n., *Chlamydomonas globulosa*, *Gonium pectorale*, *Pandorina morum*, and *Spondylomorum quaternarium*, all in great profusion. Twenty-one varieties of *Trachelomonas* had been obtained from the same place a week before.

Another noteworthy Lismore sample is No.242, from a muddy rainwater-swamp by the roadside at the foot of Girard's Hill. It yielded 20 forms of *Trachelomonas*, *Volvox Bernardii*, *Euglena tripteris* var., 5 varieties of *Lepocinclis* (*Chloropeltis*), *Synura uvella*, *Eudorina elegans* and var., *Pandorina morum*, *Chlamydomonas globulosa*, and *Chl. intermedia*, all in quantity.

SPECIES.—Altogether, 104 forms of *Trachelomonas* are mentioned below as occurring in this country. Of these, 38 are common to both Sydney and Lismore, 37 have, so far, been found only in Sydney, and 29 at Lismore only. At the former, the total number of varieties noted was 75, at the latter 67. The surface-soil, in districts where gatherings were made, was of three different kinds: at Botany, Coogee, and Centennial Park, sand; at Auburn, Canley Vale, Fairfield, Guildford, and Parramatta, clay (often right up to the surface); in the Lismore district, deep black loam. Yet, under all circumstances, the forms described retain their characteristics and dimensions, and all the common forms noted originally round Sydney are found also at Lismore, though the two districts are 350 miles apart. These species and

variations, therefore, may be relied upon to be of some fixity of character. The Lismore forms are rarer, more interesting and distinct than those from Sydney, e.g., *Tr. bulla* var. *australis*, *Tr. conica* vars., *Tr. Lismorensis*, *Tr. verrucosa* Stokes, *Tr. scabra* and vars., *Tr. eurystoma* Stein, and vars., *Tr. caudata* var. *australica*, *Tr. urceolata* var. *Girardiana*. On the other hand, the tailed forms were almost confined to Parramatta Park, and Duck Creek, Auburn.

NOMENCLATURE.—With regard to the nomenclature, of those mentioned, 25 are ranked as species, 75 as variations, and 4 as forms. The species, of course, are the *conventional* species current in microscopical studies for purposes of classification. I use the terms “species,” “variation,” and “form” as merely three degrees of comparison in distinctness of outward configuration—in *Trachelomonas*, the shape of the lorica. In the forms and variations there is generally some biological connection with the type, though not always, e.g., *Tr. clavata* var. *spinosa*, *Tr. urceolata* var. *Girardiana*, and *Tr. caudata* var. *australica*; these are each variations of a type-form, but probably are not developed from the type itself. They are neither found in company with it nor replacing it, but are collateral Australian types. The conventional species, on the other hand, are merely type-forms, and are not indicative of any biological distinctness. They do not generally, indeed, develop one into another, but each comes into existence by development from the root-form of the true species. I recognise only two biological species in *Trachelomonas*—(1) comprising all the rounded forms, (2) the tailed (stipitate) forms, and of these two even, the latter is of doubtful distinctness (*cf.* Stein, T.xxii., f.22, where *Tr. hispida* is portrayed with a tail; also *Tr. subglobosa* mihi, Pl. v., f.20, 21, which simulates *Tr. volvocina*, and of which one form is obscurely tailed). Among the rounded varieties, *Tr. volvocina* is the root-form, and in the stipitate, some minute form like *Tr. sessilis* var. *minima*, the conventional species being merely polymorphic forms of growth developed from them. I have come to realise, however, that any system of nomenclature based on polymorphism is futile. Some attempt of this kind was made by me in “Polymorphism and

Life-history in the *Desmidiaceae*” with regard to the Desmids, and also in “Plankton of the Sydney Water-Supply” with forms of *Lagerheimia* and *Peridinium*. While answering very well for genera like *Docidium*, where the forms comprised in one true species are very much alike, a system of nomenclature which makes each conventional species a variation of the oldest published type, is inconvenient for general use on account of the intricate and extensive polymorphism that prevails. And this for four reasons:—(1). It seems absurd to make widely differing types variations one of the other, even while admitting their position in the same species. (2). The oldest type is very often not the root-form of the true species, and many of the variations are more closely connected with one another than with the nomenclatural type, so that the system has not even the merit of indicating the exact biological position of the variations concerned. (3). So many of the variations have other forms intimately connected with them that it necessitates the frequent use of three-term nomenclature, which is exceedingly cumbrous. (4). The forms biologically connected together in one true species are so widely different in appearance, that only after prolonged observation can the fact of their relationship be determined; and as older and still older forms are correlated, the nomenclatural type keeps changing, to the confusion of the nomenclature. While holding, therefore, just as strongly to the position that the recognised species are mere polymorphic forms (subspecies of vastly broader true species), with regard to the nomenclature, I have returned to the generally accepted scheme. I see no reason why, for ‘convenience’ sake, we should not work in species which are frankly conventional, provided that the true state of affairs in Nature is freely recognised. The species, it is true, is a biological entity, not a conventional one, but the polymorphism of the lower orders of microscopic vegetable and animal life being as wide-spreading as it is, it is impossible to reconcile the exigencies of nomenclature (simplicity and conciseness) and biology (true connection of forms by life and growth) so that the name of an organism shall be the index of its biological position in Nature.

REPRODUCTION.—The polymorphic character of the various accepted species of *Trachelomonas* is best shown in the reproduction. It is true, no doubt, that, in permanent waters, propagation takes place largely by self-division, but it has been shown above (and indeed it is a commonplace of my experience) that the home of *Trachelomonas*, and of the green-flagellates generally, is in shallow rainwater-pools which become entirely dry at longer or shorter intervals. Under these circumstances, the Infusoria, flagellate and ciliate alike, reproduce themselves by micro-zoospores formed by the splitting up of the whole body. These micro-zoospores, settling down, form resting-cells, and when their habitat is revived by rain, the type is reproduced from the resting-cell after a longer or shorter period of vegetative growth. The vegetative stages of *Euglenā* and *Phacus* are well-known. If the various forms of *Trachelomonas* were specifically distinct, there would be a distinct resting-cell and course of development for each. But though I have paid special attention to localities such as I have mentioned, I have never found any other resting-cell than that which is directly associated with the very smallest sizes of *Tr. volvocina*. Compare my remarks on the Peridiniæ, "Plankton of the Sydney Water-Supply," p.541. I have not seen the micro-zoospores, but the act of emission is figured by Stein, *l.c.*, T. xxii, f.10 and 31. The pale colour of the lorica, in forms found in newly-filled rainwater pools or swamps, forbids the idea that the organisms have survived the dry season; they are quite evidently a new growth.

LORICA.—With regard to the composition of the lorica, Stokes, *l.c.*, p.88, quotes some remarks by Fisher (Proc. Amer. Soc. Micros., 1880) as follows :—"On testing with solution of potash or soda . . . the spines are detached from their bases, whilst the lorica remains unaffected, either in form or rigidity. Thus the probability is established that these spines, again like those of the Echinodermata, are articulated to the lorica by an organised membrane which yields to the action of the salt, and the separation is effected. On testing with hydrochloric acid, brisk effervescence immediately takes place; the main body of the lorica is dissolved. . . . The chief constituent of the lorica is, therefore, shown to be calcareous."

Nearly all the forms described in this paper have been observed in a living condition, the character of the flagellum and of the body in each case leaving no doubt that the organism was a genuine *Trachelomonas*. The specimens were carefully measured in detail, and drawn mostly to the scale of 1500 diameters, which has been reduced in the reproduction to 1000. The magnification employed in observation was that of $\frac{1}{6}$ inch objective with 15 diam. ocular.

INFUSORIA.

Family EUGLENIDÆ Stein.

Genus *TRACHELOMONAS* Ehr.

Synonyms :—*Lagenella* pro parte, *Chaetoglena* p.p., and *Chaetotyphla** Ehrenberg; *Lagenella* Schmarda; *Cryptomonas* Dujardin p.p., *Chonemonas* and *Trypemonas* Perty; *Cryptoglena* Clap. et Lachmann; *Laguncula* Fisher, Proc. Amer. Soc. Micros., 1880.

TRACHELOMONAS VOLVOCINA Ehr. (Pl. i., f.1).

Diam. 5, 10, 12, 16, 18, 20, 22, 24, 25, 26, 27, 30 μ .

Everywhere, very common.

Lorica perfectly spherical, with smooth clear membrane pale yellow to dark red. Very seldom found with a neck. Sizes over 27 μ diam. are very rare; I have observed only a single specimen. Dangeard, Les Eugléniens, p.128, has included oval forms in this species; these, however, belong to *Trach. intermedia* Dang., q.v., var. *levis* mihi.

Var. *PELLUCIDA* Playf.

Diam. 4-10 μ . Lorica quite colourless.

Botanic Gardens 158; Auburn 139; Lismore 176, 183.

Cf. Biol. Richm. R., these Proceedings, 1914, p.141, Pl. viii., f.3. Klebs, Organism. einig. Flagellatengr., p.319, has noted a variety, γ *hyalina*, but, in his form, it is the body that is colourless, without chlorophyll.

* Senn, Flagellata, p.176, gives the name as *Chaetophlyxa* Ehr.; Stein and Lemmermann refer to it as *Chaetotyphla* Ehr.

Var. PUNCTATA, n.var. (Pl. i., f.2).

Lorica levis sed crasse et densissime punctata. Diam. obs. 13, 14 μ .

Botanic Gardens 3a; Parramatta 165, 166. Rarissime.

Var. GRANULOSA, n.var. (Pl. i., f.3).

Lorica minute sed densissime granulata, plerumque achroa. Diam. 11, 12 μ .

Botany 151; Lismore 241. Rarissime.

Var. CERVICULA (Stokes) mihi. (Pl. i., f.4).

This form has the neck produced inwardly. Cf. Stokes, Proc. Amer. Phil. Soc., 1890, fig.11 (*Trach. cervicula*). Only two specimens seen.

Diam. 32 μ .

Auburn 139, 140. Very rare.

TRACHELOMONAS INTERMEDIA Dang. (Pl. i., f.5).

Lorica ovalis vel subglobosa, punctata; collo nullo.

Long. 19-22, lat. 15-17 μ .

Lismore 236, 245.

Cf. Dangeard, Recherches s. l. Eugléniens, p.135, f.42, who gives 20×16 as dimensions. The type very rare here.

Var. LEVIS, n.var. (Pl. i., f.6-8).

Lorica ovalis vel subglobosa, vulgo sine collo, levis; ore sæpe introrsum levissime producto.

Long. 15-22, lat. 12-19, lat. oris 3 μ .

Auburn 120, 135, 139, 140, 163; Guildford 114; Botany 145; Lismore 236, 237, 238, 240, 242.

TRACHELOMONAS BOTANICA, n.sp. (Pl. i., f.9).

Lorica subglobosa, levis, vulgo sine collo; a tergo minuta, obscura papilla instructa.

Long. 40, lat. 34, lat. oris 7 μ .

Botany 151. Rarissime.

Var. GRANULOSA, n.var.

Lorica formæ typicæ consimilis, minute autem granulata.

Long. 40, lat. 34 μ .

Botany 151. Cum priori, rarissime.



Var. MINOR, n.var. (Pl. i., f.10).

Long. 26, lat. 23 μ .

Auburn 163.

In this variation, if the papilla is wanting, a paler, weaker spot often marks its position.

· TRACHELOMONAS OVALIS Playf. (Pl. i., f.11).

Lorica ovalis vel oblonga, collo nullo, perfecte glabra, achroa vel luteo-fusca.

Long. 30-44, lat. 22-34 μ .

Guildford 146; Casino 189; Lismore 237.

Trach. armata is probably the outgrowth of this form, as the posterior spines do not develop *pari passu* with the rest of the lorica, but later. It is also very likely that there is a connection between this species and *Trach. Botanica*, as a broad, circular, incrassate spot is sometimes noticeable at the hinder end. Cf. these Proceedings, 1914, p.141, Pl. viii., f.4 Syn. *Tr. lagenella* Dangeard, Les Eugléniens, p.131, f.40 (non Stein).

Var. LATA, n.var.

Lorica oblonga, præ forma typica latior, collo brevissimo instructa.

Long. 38, lat. 32; lat. oris 6; coll. alt. 1 μ .

Lismore 237.

For the same length of cell, the breadth in this form is one-fifth greater than in the type.

Var. SCROBICULATA, n.var.

Lorica crasse scrobiculata, translucens, candore carnosus.

Long. 31-40, lat. 22-30 μ .

Lismore 236, 237.

This variation, like many other Australian forms, is of a pinky-yellow or very pale brown colour, quite distinct from the clear yellow of *Trach. volvocina* and others, and which I designate here by the name of buff.

Var. MINOR, n.var. (Pl. i., f.12).

Lorica levis sed scrobiculata, candore carnosus, ovalis vel oblonga, minor quam forma typica.

Long. 26-28, lat. 22-24 μ .

Lismore, 236, 237, 246.

TRACHELOMONAS BULLA var. AUSTRALIS, n.var. (Pl. i., f.13).

Lorica ovata, levis, quam forma typica magis acuminata, collo recto nec attenuato.

Long. 28-29, lat. 16; coll. alt. 2-3, lat. 3 μ .

Lismore 236, 237.

A very rare form of which I have seen but few specimens. Cf. *Trach. bulla* Stein, Naturg. d. Flagellaten, Hälfte i., T. xxii., f. 42. His figure works out at $50 \times 21 \mu$.

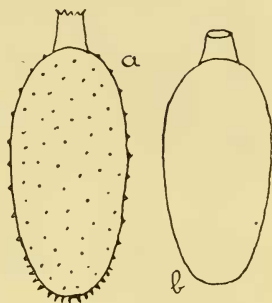


Fig. 1.—*Tr. bulla* Stein, $\times 650$, after Stein.

TRACHELOMONAS OBLONGA Lemm. (Pl. i., f.14-16).

Long. 10-19, lat. 8-12; lat. oris 3 μ .

Coogee 4; Guildford 60, 114; Auburn 68; Botany 51, 142; Centennial Park 133; Canley Vale 110; Lismore 225, 237, 238, 240, 242, 245.

Cf. Lemmermann, Reise n. d. Pacific (Abh. Nat. Ver. Bremen, Bd. xvi., 1899), p.344. No figure is given, but the likeness of our forms to var. *truncata* Lemm.

(*ibid.*, Bd. xviii., 1904, p.165, T. xi., f.7, 8) is so marked, that I think there can be no doubt about the identification.

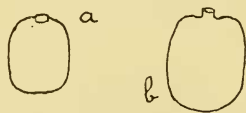


Fig. 2.—*Tr. oblonga* var. *truncata* Lemm., $\times 1000$, after Lemmermann.

Lemmermann's description runs:—Lorica oval (*länglich rund*), yellow-brown, surface smooth, 13-16 μ long, 11-12 μ broad. Membrane 1 μ thick. This description would make the type oval, yet the name "*oblonga*" has been chosen; both the published figures of var. *truncata*, i.e., are distinctly oblong, not oval, and the same expression (*länglich rund*) is used of the variation as of the type, nor is any difference in outline noted. I take it, therefore, that "*länglich rund*" here is equivalent to "*oblonga ubique rotundata*."

Var. *AUSTRALICA*, n.var. (Pl. i., f.17-21).

Lorica globosa vel plus minusve quadrata, angulis rotundatis; collo lato humillimo semper instructa; membrana levi.

Long. 11-22, lat. 10-20; coll. alt. 1, lat. 3-6 μ .

Auburn 120, 139, 140, 163; Botany 142, 145, 152; Canley Vale 110; Guildford 114; Lismore 236, 237, 238, 241, 245.

The very broad ring-shaped neck is characteristic of this form, which ranges in shape from globose to quadrate or oblong, and varies considerably in size.

Var. *ATTENUATA*, n.var. (Pl. i., f.22, 23).

Lorica levis, fronte quadrata angulis rotundatis, postice leviter attenuata et late-rotundata; vulgo collo brevi.

Long. 11-20, lat. max. 8-13 μ .

Coogee 4; Guildford 60; Centennial Park 133; Botany 142, 151; Lismore 236, 242.

Var. *SCABRA*, n.var. (Pl. i., f.24).

Lorica ubique scabra granulis humillimis obscuris sparse dispositis.

Long. 24, lat. 19; coll. alt. 2, lat. 6 μ .

Auburn 120.

TRACHELOMONAS PUSILLA, n.sp. (Pl. i., f.25).

Lorica minuta, levis, modice cordiformis, fronte levissime deplanata, postice paullulo acuminata; collo nullo; ore lato.

Long. 10-16, lat. 9-16 μ .

Canley Vale 110; Guildford 114; Botany 142, 151, 152; Lismore 242, 245.

Var. *ROTUNDA*, n.var. (Pl. i., f.26).

Lorica levis ubique rotundata, nec acuminata, globosa, fronte levissime deplanata; ore lato.

Long. 11-12, lat. 10 μ .

Auburn 163; Botany 151; Guildford 114; Lismore 238, 242.

Var. *PUNCTATA*, n.var. (Pl. i., f.27).

Long. 15, lat. 14 μ . Botany 145.

TRACHELOMONAS CYLINDRICA Ehr. (Pl. i., f.28, 29).

Lorica smooth, cylindrical with parallel sides, broadly rounded behind, more or less shouldered in front, but our forms are not generally so rectangular as those figured by Stein, with a low ring-shaped neck.

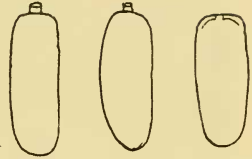


Fig. 3.—*Tr. cylindrica* Ehr.,
× 650, after Stein.

Long. 16-20, lat. 8-10; coll. alt. 1, lat. 3 μ .

Botanic Gardens 3; Auburn 120; Botany 142, 145, 152; Lismore 236, 237, 241, 242.

Var. DECOLLATA, n.var. (Pl. i., f.30).

Lorica levis, cylindracea, plerumque latior; colle nullo.

Long. 16-20, lat. 8-10 μ .

Botanic Gardens 3.

Var. PUNCTATA, n.var. (Pl. i., f.31).

Lorica major, punctata, fronte posticeque vulgo late-rotundata; collo brevi humillimo.

Long. 26-38, lat. 12-14; coll. alt. 1, lat. 4 μ .

Botany 142, 152; Lismore 242.

This form is not only punctate, but larger than the type, the breadth of which is commonly about 8 μ , while var. *punctata* is just as regularly about 12 μ .

TRACHELOMONAS PULCHERRIMA, n.sp. (Pl. i., f.32, 33).

Lorica levis, candore carnosus, anguste-elliptica; apicibus late-rotundatis; lateribus leniter arcuatis; collo humillimo aut nullo.

Long. 20-26, lat. 9-12; coll. alt. 1-2, lat. 4 μ .

Centennial Park 11; Botany 91, 151, 152; Lismore 240, 241, 242.

Var. LATIOR, n.var. (Pl. i., f.34, 35).

Lorica levis sed sæpe punctata, præ forma typica latior, æqualiter elliptica; apicibus late-rotundatis; collo plerumque nullo.

Long. 20-27, lat. 12-14 μ .

Botany 151; Lismore 236, 237, 238, 245.

Differs from the type principally in its relatively greater breadth; long.:lat. = 1.5 to 1.8:1 but, in the type, 2.0 to 2.4:1. The neck also is generally wanting and the lorica often punctate.

Var. *OVALIS*, n.var. (Pl. i., f.36).

Lorica var. *laticioris* dimensionibus sed ovalis, polos versus magis acuminata, lateribus magis arcuatis, apicibus rotundatis; collo nullo; membrana dilute fulva interdum punctata.

Long. 22-23, lat. 13-15; lat. oris 4 μ .

Botany 151; Lismore 245.

Oval-elliptic, instead of linear-elliptic, with sides converging from the centre to the ends.

Var. *MINOR*, n.var. (Pl. i., f.37, 38).

Lorica minor, cetera ut in formis duabus precedentibus.

Long. 12-19, lat. 8-12 μ .

Botany 151, 152; Lismore 240, 242.

Includes both the preceding forms in smaller sizes.

Var. *LISMORENSIS*, n.var. (Pl. i., f.39, 40).

Lorica collo quadrato valido instructa.

Long. 25-26, lat. 10-11; coll. alt. $2\frac{1}{2}$ -3, lat. 3-4 μ .

Lismore 236, 237, 241.

Var. *GRANULOSA*, n.var. (Pl. i., f.41).

Lorica minute granulata; collo humillimo.

Long. 25-28, lat. 11-14; coll. alt. 1, lat. 4 μ .

Botany 142.

Trach. pulcherrima is a close connection of *Trach. cylindrica*, from which it differs in the gently arched, not parallel, sides. It is also much more variable than that species.

TRACHELOMONAS VOLZII var. *PELLUCIDA*, n.var. (Pl. ii., f.1).

Lorica ut in forma typica, levis autem et pellucida, nec punctata nec granulata; candore carnosio pæne hyalino.

Long. 34, lat. 18 μ .

Botany 142; rarissime.

Lemmermann gives $32 \times 15 \mu$, Dr. Volz gessam. süßsw. Alg., p.166, T. xi., f.9. *Trach. Volzii* is ovate, broader behind than before, neck with pointed sides in optical section. The type is described as granulate (the figure, however, has a smooth outline) and yellow-brown in colour. Var. *pellucida* is pale buff, almost colourless, and neither punctate nor granulate. Only one specimen noted. It is a young form of var. *australis*, infra, with

which it is connected by var. *intermedia*. All three are stages of development.

Var. AUSTRALIS, n.var. (Pl. ii., fig.2).

Lorica levis, subovata, postice latior, collo quadrato valido semper instructa; parte majore corporis suboblonga, fronte usque ad collum attenuata, a tergo latissime-rotundata: collo ad basin annulo incrassato plerumque ornato.

Long. 34-38, lat. 16-20; coll. alt. 4, lat. 4 μ .

Botany, 108, 142, 152; Lismore 225, 240, 241.

This is the full-grown form of *Trach. Volzii*, and a very distinct type; the colour is generally a clear yellow.

Var. INTERMEDIA, n.var. (Pl. ii., f.3).

Lorica in ambitu ut in var. *australi* sed angustior, collo autem ad formam typicam potius pertinente.

Long. 34; lat. fronte 11, postice 15; coll. alt. 3, lat. 3 μ .

Botany 142. Cum forma typica.

I had var. *australis* down as a separate type (it is much more common than the other two forms) when I came across *Tr. Volzii* and this variation, both in the same gathering, showing unmistakably the connection of all three. Var. *intermedia* has the thin outer primordial membrane of the lorica stretched between the shoulder and the tip of the neck as in *Tr. Volzii*, type.

Var. CYLINDRACEA, n.var. (Pl. ii., f.21).

Lorica modice cylindracea, lateribus parallelis; a tergo late-rotundata; a fronte conica, lateribus ad collum convergentibus; collo recto valido, annulo basali ornato, instructa; membrana levis.

Long. 34-38, lat. 16; coll. alt. 4-5, lat. 4 μ .

Centennial Park 133; Botany 152.

This form has not, so far, been noted at Lismore, but it is almost certain to turn up eventually. It lies between var. *intermedia* and var. *australis*. The latter is broader and more ovate.

TRACHELOMONAS EUCHLORA (Ehr.) Lemm., forma. (Pl. iii., f.1).

Lorica ovalis vel oblonga, semper autem minus rectangularis quam forma typica.

Long. 29-30, lat. 19-20; coll. alt. 5, lat. 4 μ .

Lismore 236, 237, 242, 245.

Syn., *Lagenella euchlora* Ehr., *Trachelomonas lagenella* Stein, *Chonemonas Schrankii* var. *glabra* Perty. The name *lagenella* is not admissible, having been used in a generic sense both by Ehrenberg and by Schmarda. Our forms are more rounded, less rectangular, than Stein's type, (Naturg. d. Flagell., H.i., T. xxii., f. 14-16) which works out at $30 \times 17 \mu$ over all. The characteristic curved neck is still present, however. This form is rather local, apparently, as I have not observed it in any of the many rich gatherings from the suburbs of Sydney, but it is found sparsely distributed round Lismore, and is even frequent in Nos. 236 and 245. *Tr. similis* Stokes, Proc. Am. Phil. Soc., 1890, p. 76, f. 12, should be arranged here as *Tr. euchlora* var. *similis* (Stokes) mihi.

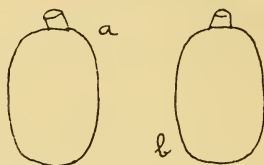


Fig. 4.—*Tr. euchlora* (Ehr. Lemm., $\times 650$, after Stein.

Var. MINOR, n.var. (Pl. ii., f. 4, 5).

Lorica levis, late-oblonga pæne quadrata, angulis late-rotundatis; a tergo interdum rotundata levissime attenuata; collo recto quadrato valido, ad basin annulo incrassato ornato.

Long. 18-23, lat. 15-18; coll. alt. 2-4, lat. $2-4 \mu$.

Botany 142, 151, 152; Canley Vale 110; Lismore, 225, 238, 241, 242, 245.

TRACHELOMONAS AMPULLULA, n.sp. (Pl. ii., f. 6).

Lorica levis, subhexagona, medio lateribus pæne parallelis, extremis conica; collo quadrato recto, plerumque sine annulo basali, instructa.

Long. 24-30, lat. 10-16; coll. alt. 2-4, lat. 3μ .

Canley Vale 110; Guildford 114; Botany 142; Parramatta 165, 166; Lismore 236, 237, 238.

A very distinct species with little or no variation in form or markings; some specimens are a little more markedly hexagonal than others, the sides more angular. The posterior end also is occasionally somewhat mammillate. It is the only form of *Tra-*

chelomonas that swims backwards, with the orifice and flagellum behind.

Var. MAJOR, n.var. (Pl. ii., f.7).

Lorica major, formæ typicæ similis, postice levissime retusa, mammillata; collo quadrato recto valido, plerumque annulo basali instructo.

Long. 34-41, lat. 15-18; coll. alt. 4-5, lat. 4 μ .

Botany 145; Lismore 263, 238, 241.

This larger form is rare round Sydney, but frequent in the neighbourhood of Lismore.

TRACHELOMONAS CONICA, n.sp. (Pl. ii., f.8, 9).

Lorica conica levis; parte anteriore subrectangulari, lateribus parallelis, angulis late-rotundatis; parte posteriore conica, lateribus levissime arcuatis, a tergo obtuse-rotundatis; collo nullo aut humillimo.

Long. 24-26, lat. 12-14; lat. oris 2-4; coll. alt. 1 μ .

Auburn 56; Botanic Gardens 3, 158; Guildford 146; Lismore 225, 238.

Always very uncommon in gatherings, though widely distributed; generally without a neck.

Var. GRANULATA, n.var. (Pl. ii., f.10).

Paullo major, minute granulata. Long, 36, lat. 12 μ .

Auburn 56. Cum forma typica.

Var. RICHMONDIÆ, n.var. (Pl. ii., f.11).

Lorica subelliptica angusta; polo anteriore late-rotundata, posteriore conica acuminata; spinis obtusis brevissimis (pæne granulis) ubique ornata; collo nullo.

Long. 34, lat. 14; lat. oris 4 μ .

Lismore 225. A river-form.

Var. OVATA, n.var. (Pl. ii., f. 12).

Lorica anguste-ovata, lateribus arcuatis; fronte late-rotundata, a tergo acuminata; ubique spinis brevissimis sparse ornata; collo humillimo.

Long. 37, lat. 18; coll. alt. 1, lat. 6; spin. long. ad $1\frac{1}{2}$ μ .

Lismore 236.

Var. *CAUDATA*, n.var. (Pl. ii., f.13, 14).

Lorica inæqualiter elliptica, interdum extremum versus paullo latior, a tergo in caudam brevissimam truncatam protracta; collo nullo, ore lato; membrana spinis minutis sparsis ornata.

Long. 38-42, lat. 18-20 μ .

Lismore 236, 241.

TRACHELOMONAS CLAVATA, n.sp. (Pl. ii., f.15).

Lorica lageniformis, clavata, levis; parte anteriore conica, in collo longo recto ore everso producta; parte posteriore subrect-angulari, ad basin truncatam levissime attenuata, lateribus fere rectis.

Long. 54, lat. 20; coll. alt. c. 10, lat. 4 μ .

Botanic Gardens 3.

A very rare form; the specimen observed had a very tenuous membrane absolutely hyaline.

Var. *SUBARMATA*, n.var. (Pl. ii., f.16).

Lorica ut in forma typica sed luteo-fusca et scrobiculata; polo posteriore spinis minutis paucis instructa.

Long. 60, lat. 26; coll. alt. 10, lat. 6 μ .

Botanic Gardens 137.

TRACHELOMONAS CACTACEA, n.sp. (Pl. ii., f.17).

Lorica ovalis fronte autem quam levissime attenuata, granulis minutis sparse ornata, collo humillimo.

Long. 38, lat. 23; coll. lat. 6 μ .

Botanic Gardens 150.

A very rare form, only once noted. There might possibly be some connection between it and *Trach. bulla* var. *regularis* Lemm., Dr Volz gess. Alg., T. xi., f.6, but the latter is hardly rightly placed as a variation of *Trach. bulla* Stein.

TRACHELOMONAS GRANULOSA, n.sp. (Pl. ii., f.18).

Lorica ovalis, interdum plus minusve acuminata, granulis minutis dense oblecta; collo humillimo aut nullo.

Long. 17-26, lat. 13-22 μ .

Guildford 146; Centennial Park 133; Canley Vale 110; Fairfield 143; Botanic Gardens 150; Auburn 135, 139, 148; Botany 142, 145, 151, 152; Lismore 240, 242.

Common and widespread. The puncta-granules are minute, and merely give the edge a sandy appearance. It is possible that the forms of this species, which are generally oval and more rarely subglobose, should be arranged as granulate variations of *Trach. intermedia* Dangeard. There is nothing specifically characteristic in the condition of the membrane; smooth, punctate, and granulate are merely three degrees of development due to the age of the infusorian, and probably also to the stagnation of its habitat. Each of them may (and often does) occur in unmistakable forms of the same species, e.g., *Tr. volvocina*, *Tr. pulcherrima*, *Tr. conica*.

Var. SUBGLOBOSA, n.var. (Pl. ii., f.19).

Lorica subglobosa. Long. 19-28, lat. 17-26 μ .

Botany 142, 151; Lismore 236, 245.

Var. OBLONGA, n.var. (Pl. ii., f.20).

Lorica late-oblonga sed non quadrata. Long. 24, lat. 20 μ .

Guildford 114.

TRACHELOMONAS AUSTRALIS, n.sp. (Pl. iii., f.2).

Lorica cylindracea, lateribus parallelis, polis late-rotundatis; vulgo collo nullo; minute dense granulata; candore carnosio.

Long. 24-30, lat. 14-18; lat. oris 4 μ .

Botanic Gardens 150; Canley Vale 110; Guildford 70, 146; Fairfield 79; Botany 142, 145, 151, 152; Lismore 238, 240.

This form has the same minute granulation as *Tr. granulosa*, but its cylindrical shape makes it very distinct. It differs also in colour, being generally pale biscuit-colour or buff, whereas *Tr. granulosa* is generally deep yellow, reddish-yellow, or dark red.

Var. OBESA, n.var. (Pl. iii., f.3).

Lorica præ forma typica latior, minus cylindracea, lateribus modice arcuatis nec planis.

Long. 28-34, lat. 20-25; lat. oris 4 μ .

Botanic Gardens 150; Parramatta Park 96; Fairfield 79; Botany 151; Lismore 236, 237.

Broader and less cylindrical than the type, with slightly arched sides. Its finer granulation alone distinguishes it from *Trach. hispida* var. *granulata*.

Var. *SPLENDIDA*, n.var. (Pl. iii., f.4).

Lorica dimidio præ forma typica longior, strictius cylindracea; polis magis truncatis.

Long. 45, lat. 20 μ . Botany 37.

Var. *ARCUATA*, n.var. (Pl. iii., f.5).

Lorica oblonga nec cylindracea; lateribus arcuatis nec deplanatis; polis late-rotundatis.

Long. 20-27, lat. 14-17 μ .

Botany 151; Lismore 236, 238.

Var. *CONICA*, n.var. (Pl. iii., f.6).

Lorica a tergo paullo conica. Long. 30, lat. 18 μ .

Guildford 146; Lismore 237.

Var. *SUBDENTICULATA*, n.var. (Pl. iii., f.7).

Lorica modice cylindracea, major quam forma typica; granulis minutis acuminatis (pæne denticulis) sparse ornata.

Long. 36, lat. 22 μ .

Lismore 240. Cum forma typica.

It is doubtful whether this form should be placed under *Tr. australis* or *Tr. hispida*, forms of the latter being granulate. Of the two, only *Tr. australis* accompanied it in No.240, so I have arranged it under that species.

TRACHELOMONAS HISPIDA (Perty) Stein. (Pl. iii., f.8).

Long. 26-29, lat. 19 μ , sine spinis.

Lismore 238.

According to Stein, *l.c.*, T. xxii., f.20-34, the type is oval or oblong, and covered with sharp-pointed spines. Such a form is extremely rare in our waters; I find it only in No.238, and sparsely distributed even there. The dimensions, however, agree exactly with those of Stein, whose figures work out at 29×20 , 26×20 , 26×17 , 27×19 μ , &c. *Tr. crenatocollis* Maskell, (Trans. New Zealand Inst., Vol.19, n.s., 1886, Pl. iii., f.3) is an oval form of *Tr. hispida*, with square, straight neck crenate at the end, corresponding to Stein's figs. 21, 24. *Tr. piscatoris* (Fisher) Stokes, Infus. U. S., p.88, Pl. i., f.25 (*Laguncula piscatoris* Fisher, and *Laguncula Kellicottiana* Fisher, Proc. Amer. Micr. Soc., 1880) is the corresponding oblong form. If both are re-

tained, they should stand as *Tr. hispida* var. *crenatocollis* (Maskell), and *Tr. hispida* var. *piscatoris* (Fisher), respectively; the latter has priority. I have not found either here yet.

Var. AUSTRALICA, n.var. (Pl. iii., f.9).

Lorica ovalis vel oblonga, collo nullo, spinis obtusis bacillaribus dense oblecta.

Long. 32, lat. 22 μ ; dimensiones etiam var. *granulata*, infra.

Guildford 45, 76.

A form of *Tr. hispida* a little larger than the type and characterised by short, blunt, bacillar spines set, as usual in this species, very close together, and showing at the edge (as Maskell observes of *Tr. crenatocollis*) "a continuous border of points." This would be the Australian type of the species, were it not so rarely found; as it is, that honour falls to the succeeding variety, of which var. *australica* is the fully developed spinous form.

Var. GRANULATA, n.var. (Pl. iii., f.11, 12).

Lorica crasse denseque granulata nec spinosa; collo nullo.

Long. 27-42, lat. 17-35 μ .

Botany 142, 145; Guildford 45, 77, 114; Centennial Park 133; Casino 189; Lismore 236, 237, 238, 241, 242, 245.

The prevailing type in this country; it is a form of var. *australica* in which the granules have not developed into the usual bacillar spines of that variety. Intermediate states exist, and, even in granular forms, the polar granules are very often produced as very short spines. The dimensions most commonly observed are, long. 30-34, lat. 20-24 μ . In shape, the lorica is oblong or oval-oblong, more rarely distinctly oval, dark brownish-yellow in colour.

Var. RECTANGULARIS Br. Schröder. (Pl. iii., f.10).

Lorica rectangularis, lateribus planis, apicibus truncatis vel rotundato-truncatis, angulis rotundatis, spinis *vel granulis* dense ornata.

Long. 31-36, lat. 18-20 μ .

Botany 37, 142; Centennial Park 133; Lismore 238.

Cf. Stein, *l.c.*, T. xxii., f.34; Schröder, *Fischereiv. z. Trachenberg*, T. ii., f.8. This form is closely connected with var. *aus-*

tralica and var. *granulata*. It is found here sometimes with short, blunt, bacillar spines as in the former, or coarsely granulate as in the latter. Even in Stein's figure the spines are noticeably blunter and more bacillar in shape than those of the typical form. Stein's figure works out at 38×16 , Schröder's at 48×21 , without spines. The spines in all these forms, as far as my observations go, are never over 2μ long.

TRACHELOMONAS BACILLIFERA, n.sp. (Pl. iii., f.13).

Lorica subglobosa, spinis obtusis bacillaribus dense oblecta; collo nullo; colore plerumque obscuro.

Long. 35-40, lat. 32-38, sine spinis; sp. long. ad 2μ .

Auburn 68; Guildford 114; Botanic Gardens 150; Centennial Park 133.

The spines in all forms of this species are of the same character as those in *Tr. hispida* var. *australica*, supra. The type-form is almost spherical, and almost always very dark in colour, generally dark red or dark reddish-orange.

Var. *OVALIS*, n.var. (Pl. iii., f.14).

Lorica late ovalis, spinis ut in forma typica.

Long. 38-42, lat. 32-34, sine spinis; sp. long. ad 2μ .

Auburn 68; Guildford 114; Canley Vale 110; Lismore 254.

Var. *MINIMA*, n.var. (Pl. iii., f.15, 16).

Lorica subglobosa, oblonga vel ovalis, sed minor; spinis ut in forma typica.

Long. 22-28, lat. 18-26, sine spinis; sp. long. ad 2μ .

Auburn 148; Coogee 4; Botany 151, 152; Lismore 237, 238, 242, 245.

TRACHELOMONAS SYDNEYENSIS, n.sp. (Pl. iv., f.15, 16).

Lorica elliptica, lateribus interdum quam levissime deplanatis, polis rotundatis; collo humillimo crenato vel spicato semper instructa; spinis acutis brevibus, vel denticulis (regione equatoriali plerumque denticulis) sparse ornata; colore vulgo carnoso vel dilute flavescente.

Long., collo incl., 32-45, lat 22-26, s. sp.; sp. long. ad $4\ \mu$, vulgo $2\ \mu$; coll. alt. 1-3, lat. 6-10 μ .

Auburn 57, 119, 140, 148, 149, 163; Guildford 45, 114, 146; Botany 92, 145; Canley Vale 110; Centennial Park 133; Botanic Gardens 137; Lismore 225, 241, 245, 254.

Common and widespread; quite distinct from *Tr. hispida*, and easily distinguished from it under the microscope. The lorica is elliptic or long-oval, sometimes slightly flattened at the sides, whereas *Tr. hispida* (here at any rate) is nearly always oblong or oval-oblong. Its colour is characteristic also, being generally a pale straw-colour, the membrane thin and transparent. *Tr. hispida* is nearly always dark yellow or red, the membrane incrassate. The spines in *Tr. Sydneyensis* are sharp-pointed but very sparsely distributed, so that they do not show at the margin the "continuous border of spines" characteristic of *Tr. hispida*. Moreover, the spines, as a rule (almost invariably), are nothing more than mere denticulations not above $2\ \mu$ long, and reduced towards the centre; out of 20 records, I have only one with longer spines. The neck is a low band, broader above, with a crenate or spicate margin, and is nearly always present; in *Tr. hispida*, it is consistently wanting; I have only one record in 28 of a collar ($2 \times 5\ \mu$) in that species. The spines are occasionally bacillar in character, in which case the denticulations are represented by minute granules.

Var. OBLONGA, n.var. (Pl. iv., f.17).

Lorica oblonga ubique rotundata, cetera ut in forma typica.

Long. 46-48, lat. 34-36 μ , sine spinis.

Botany 151; Kyogle 218, 219.

Var. MINIMA, n.var. (Pl. iv., f.18).

Lorica minor, late-ovalis vel subglobosa, cetera ut in forma typica.

Long. 26-28, lat. 21-24, sine spinis; coll. lat. $4\ \mu$.

Auburn 135, 140; Botany 151.

Var. OBESA, n.var. (Pl. iv., f.19).

Lorica exacte late-ovalis, præ longitudine latior quam in f. typica, fronte et a tergo spinis minutis acutis sparsis vestita, in

medio spinis ad denticulos reductis; collo humillimo ore dentato; membrana translucente dilute luteola.

Long. 36, lat. 25-26; coll. alt. 2, lat. 7; spin. long. ad 2μ .

Guildford 45; Lismore 245.

A broader oval than the type, with minute spines sparsely distributed at each end, but reduced to denticulations, or entirely wanting, towards the middle. Found in quantity in rainwater pools on grass-land; interspersed were many specimens entirely smooth.

TRACHELOMONAS ARMATA (Ehr.) Stein.

Chl. corpore ovato subgloboso, utrinque rotundato, fusco, ubique setis brevibus hispido, corona apiculorum postice nigra.

The above is Ehrenberg's description of his *Chaetotyphla armata*; it indicates a broadly ovate lorica covered with short spines, and with a ring of short, somewhat stouter spines behind. Such a form, I have never seen, the nearest to it being var. *longispina*, infra, which differs from Ehrenberg's description only in the great length of the posterior spines.

Var. *GLABRA*, n.var. (Pl. iii., f.17).

Lorica oblonga vel ovale-oblonga, perfecte glabra interdum punctata, a tergo corona spinarum validarum ornata, inter coronam interdum paucis spinis minutis.

Long. corp. 34-46, lat. 28-34; spin. c. 10-16, long. 2-8 μ .

Botany 151; Guildford 114; Parramatta 96, 165, 166; Lismore 241, 242.

This is Stein's, T. xxii., f.37. Upon f.38, Lemmermann has founded *Tr. armata* var. *Steinii* Lemm., which is smooth, but with small scattered spines at the anterior end, besides the posterior ring of larger awns. Cf. Dr. Volz gess. süssw. Alg. p.165, where he gives the size as 29 μ long and 22 μ broad. This is somewhat smaller than any I have noted. Stein's figures measure $37 \times 27\mu$ without spines, corresponding almost exactly to the smallest sizes here. Australian forms are invariably smooth or granulate; excepting the very rare var. *longispina* described below, I have never seen a specimen that could be described as hispid.

Var. GRANULATA, n.var. (Pl. iii., f.18).

Lorica crasse denseque granulata, spinis posterioribus plerumque parvis.

Long. corp. 38-44, lat. 30-34; spin. c. 9-14, long. ad 5μ .

Guildford 114; Fairfield 143; Parramatta 165, 166; Lismore 242.

Very often found in company with var. *glabra*. The forms of *Tr. armata* are all of large size; the dimensions of all its variations are about the same, viz., $40-46\mu$ long and $30-35\mu$ broad, with occasional specimens as low as $34 \times 28\mu$ and as high as $50 \times 36\mu$; the most common length, without spines, is 40μ .

Var. SPARSIGRANOSA, n.var. (Pl. iii., f.19).

Lorica ut in f. typica, sed granulis vel spinis obtusis brevissimis sparsissime (polos versus densius) ornata, granulorum vice interdum denticulis.

Long. corp. 40-50, lat. 30-36; spin. c. 6, long. ad 6μ .

Canley Vale 110; Guildford 114; Botanic Gardens 150; Lismore 236.

In this form, the short spines are merely elongated granules. Fairly dense at the poles, especially the anterior one, they become very scattered towards the equator, where they are reduced to granules.

Var. LONGISPINA, n.var. (Pl. iv., f.20).

Lorica ovata subglobosa, postice latior, ubique rotundata; spinis validis acutis brevibus ubique vestita, a tergo spinis gracilioribus; aculeis posterioribus magnis curvatis plerumque 4-6 instructa.

Long. corp. 43-44, lat. 32-34; spin. long. 5-6; acul. post. 4-10, long. ad 24μ .

Botany 37; Botanic Gardens 137, 150.

Var. DUPLEX, n.var. (Pl. iii., f.20).

Lorica ovato-oblonga, postice paullo latior, crasse sparseque granulata, polum anteriorem versus glabra; fronte et a tergo corona spinulorum ornata, spinis anterioribus rectis obtusis bacillaribus circa 12, posterioribus longioribus acutis recurvatis circa 10, ad os dentibus 4; colore fusco.

Long. corp. 46, lat. max. 35; spin. anter. long. 8μ , poster. 12μ .

Lismore 240.

TRACHELOMONAS *LISMORENSIS*, n.sp. (Fig.5).

Lorica a vertice visa circularis, spinis radiantibus sparse ornata, ore minuto spinis minutis paucis circumcincto. A latere subglobosa, depressa, anteriore subplana, posteriore rotundata, spinis sparsis radiantibus, plerumque spinorum longiorum serie equatoriali singula. Colore atro luteo-fulvo.

Diam. corp. 20; spin. long. ad 4, oris diam. 2 μ .

Lismore 225.

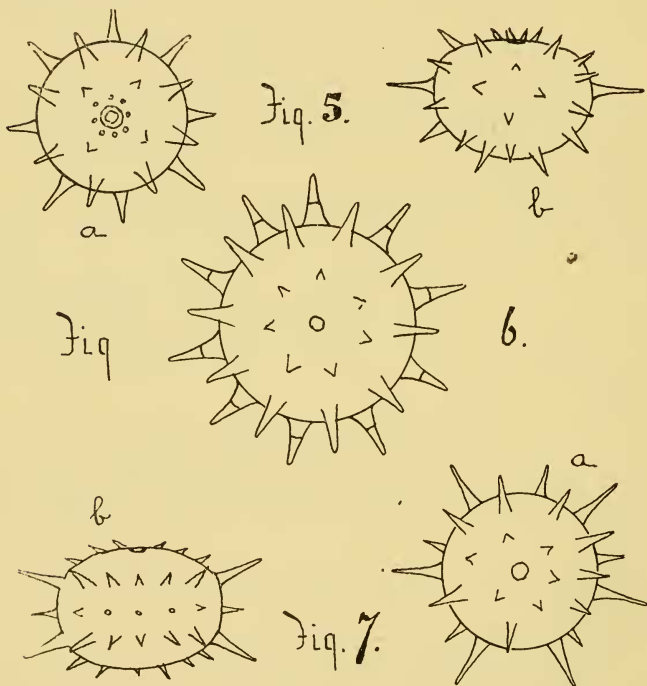


Fig.5.—*Trachelomonas* *Lismorensis*. Fig.6.—Var. *mirabilis*.

Fig.7.—Var. *biseriata*. All $\times 1000$.

Var. *MIRABILIS*, n.var. (Fig.6).

Lorica vertice visa spinis validis circa 10 regularius ordinata, spinarum parte externa achroa. Cetera ut in f. typica.

Diam. corp. 26, spin. long. ad 6 μ .

Lismore 241.

I have not seen this form in side-view, so cannot determine whether it inclines to the type or to the next variation. It is a little larger than usual, the spines stouter and more regular; the inner third of the spines is the colour of the lorica, the outer part is colourless.

Var. *BISERIATA*, n.var. (Fig.7).

Lorica depresso-ovalis, ubique rotundata, spinis minutis sparse ornata, spinarum longiorum seriebus binis utrinque ad medium circumcincta.

Diam. corp. 20; sp. long. ad 6 μ .

Lismore 241.

In this species, the type seems to be a form of *Tr. volvocina* which has developed the posterior spines of *Tr. armata*. This variation reproduces the anterior and posterior series of *Tr. armata* var. *duplex*. The two rows of spines are, of course, close together, and this is evidence of the fact that the growth of the lorica takes place mainly in the equatorial region.

Var. *INERMIS*, n.var. (Pl. iii., f.21).

Lorica ut in forma typica sed spinis nullis.

Alt. circa 14-18, lat. 17-22 (rarissime 34) μ .

Auburn 139, 140; Botany 142, 151; Lismore 236, 237, 241.

I found this form in my Sydney gatherings (notably Auburn 140, in which it occurs plentifully) before I discovered the mature form at Lismore. The latter is very rare, even where it is to be observed at all. Var. *inermis* is very liable to be overlooked in gatherings. Resting, as it does, always on one end, it appears circular from above, and may be mistaken for *Tr. volvocina*, in company with which it is often found.

Var. *OBLONGA*, n.var. (Pl. iii., f.22).

Lorica ut in var. *biseriata*, sed spinis nullis.

Diam., vertice visa, 12; alt., a latere, 8 μ .

Guildford 70. Very rare.

A smooth form of var. *biseriata*. Although I have seen no intermediate forms, yet there is such a close agreement in the side-view of all these forms, that I must consider them variations of the same species.

TRACHELOMONAS VERRUCOSA Stokes. (Pl. iv., f.1).

Lorica globosa, minutis papillis achrois sparse ornata; collo nullo.

Diam. 18 μ . Lismore 225; very rare.

Cf. Stokes, *Infus. U. S.*, p.88. He gives diam. 24 μ . It should, perhaps, be arranged as a variation of *Tr. volvocina*, but I have seen only one specimen.

TRACHELOMONAS SCABRA, n.sp. (Pl. iv., f.2, 3).

Lorica ovalis æqualiter rotundata vel postice acuminata; collo lato brevissimo; membrana scabra non autem ordine granulata.

Long. 29-33, lat. 20; coll. alt. 2-4, lat. 4-5 μ .

Lismore 238, 242.

This species is very distinct; all its forms are easily recognised by the characteristic membrane. The surface is rough all over, not with granules but with minute protuberances irregularly disposed. The colour is generally pale yellow.

Var. *LONGICOLLIS*, n.var. (Pl. iv., f.4-6).

Lorica et membrana ut in forma typica, collo autem longissimo, recto vel obliquo vel curvato, interdum ore everso.

Long. 29-33, lat. 19; coll. alt. 6-7, lat. 3-5, lat. oris 6 μ .

Lismore 238.

Var. *OVATA*, n.var. (Pl. iv., f.7, 8).

Lorica ovata, anteriore ovalis, posteriore acuminata, extremo producta conica; collo quadrato vel brevissimo.

Long. 34-46, lat. 20-22; coll. alt. 2-6, lat. 5-6; caud. long. 4-6, lat. 3-4 μ .

Lismore 237, 238, 241.

Var. *SCROBICULATA*, n.var. (Pl. iv., f.9).

Lorica ut in var. *ovata*, glabra autem et crasse scrobiculata pæne reticulata; collum interdum annulo basali instructum.

Long. 36-42, lat. 20-22; coll. alt. 3-4, lat. 4-6; caud. long. 2-5 μ .

Lismore 236.

The outline in this form is smooth, showing that the surface is level, but the membrane itself is so perforated with wide scrobiculæ as to be almost reticulated.

Var. ELLIPTICA, n.var. (Pl. iv., f.10).

Lorica elliptica, a tergo acuminata: collo brevissimo plerumque obliquo; membrana scabra.

Long. 31, lat. 16; coll. alt. 2, lat. 7 μ .

Lismore 242.

Var. CORDATA, n.var. (Pl. iv., f.11).

Lorica cordata, a tergo acuminata; collo brevissimo recto.

Long. 21, lat. 18; coll. alt. 2, lat. 3-4 μ .

Lismore 242.

Var. PYGMÆA, n.var. (Pl. iv., f.21).

Lorica ovalis, a tergo in caudam brevissimam truncatam producta; collo lato humillimo; membrana inæqualiter scabra.

Long. 34-35, lat. 18-20; coll. alt. 2-3, lat. 9-10 μ .

Wyrallah, mere on grass-land.

TRACHELOMONAS EURYSTOMA Stein, forma. (Pl. iv., f.12).

Lorica quam in f. typica magis rotundata, a tergo minus acuminata; collo paullo brevior, emarginato haud sulcato; membrana subtilissime et oblique striata, striis interdum undulatis; colore dilute fusco.

Long. 26, lat. 19; coll. alt. 1, lat. 9 μ .

Lismore 244.

Cf. Stein, Naturg. d. Flag., H. 1, Pl. xxii., f.35, whose figure measures 31 \times 21.

The form found here has a shorter neck, not sulcate, and with emarginate edge, the mouth not quite so wide. The lorica

is pale brown, sometimes with a purple tinge, and is finely and faintly striate obliquely downwards from right to left, not *vice versâ*, as in Euglena and Lepocinclis. The striæ are lines of partly coalesced scrobiculæ.

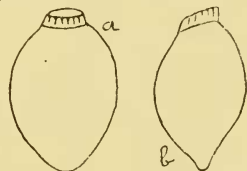


Fig. 8. — *Tr. eurystoma* Stein, \times 650, after Stein.

Var. PRODUCTA, nom.nov. (Pl. iv., f.13).

Forma a tergo producta, conica, acuminata. Cf. Stein, *l.c.*, f.36.

Long. 27, lat. 18; coll. alt. 1, lat. 6 μ .

Lismore 244, cum priori.

Var. *KLEBSII* mihi. (Pl. iv., f.14).

Lorica ovata, a fronte rotundata, a tergo modice acuminata, oblique striata; collo nullo.

Long. 24-26, lat. 18; lat. oris 6 μ .

Lismore 244, cum prioribus duabus; 245.

Syn. *Tr. reticulata* Klebs, Organiz.ein.Flag., 1885, cf. Dangeard, Les Eugléniens, p.137, f.43. The name *reticulata* is unsuitable, as probably the type is reticulate also. Stokes' *Tr. obovata*, New Frw. Infus., Amer. Philosoph. Soc., 1890, p.76, f.13, is also almost certainly a form of this species; if it is really hispid, it might stand as var. *Stokesii* mihi, the type being just as much obovate. It is possible, however, that it is the same as *Tr. reticulata* Klebs, and the hispid appearance due to pores running through the walls of the lorica. The inner margin of the membrane is often very distinct, while the outer edge is extremely vague; the pores then show as fine granules or setæ upon what appears to be the surface.

TRACHELOMONAS CAUDATA var. *AUSTRALICA*, n.var. (Pl. v., f.1, 2).

Lorica ut in forma typica, corpore autem brevior, spinis nullis, membrana aspera.

Long. 62-96, lat. 18; coll. long. 14-20, lat. 5; caud. long. 18-30, lat. max. 4-6 μ .

Lismore 238. Wyrallah, mere on grass-land.

This is the nearest I have seen to Stein's *Tr. caudata*, l.c., Pl. xxii., f.39, 40. It has an entirely different surface, lacking the spines, and the body is shorter in proportion to the total length. Stein's f.40 agrees perfectly in general dimensions, working out at long. 64 (neck 9, body 41, tail 14), lat. 18½ μ . The slender form of the same breadth was found at Wyrallah, alive. It is a genuine *Trachelomonas*.

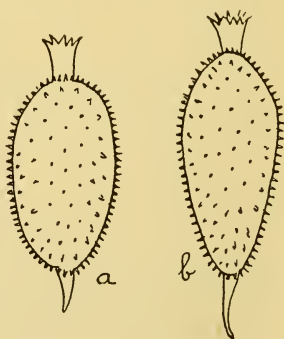


Fig.9.—*Tr. caudata* (Ehr.)
Stein, $\times 650$, after Stein.

TRACHELOMONAS ACUMINATA var. AMPHORA, n.var. (Pl. v., f.3).

Lorica, ut in forma typica, corpore inferne latissimo sed lateribus late-rotundatis nec angulatis, ad collum sensim convergentibus.

Long. 46, lat. 28 ; coll. alt. 8, lat. 6 ; caud. long. 6 μ .

Parramatta 136.

Like the type, *Tr. acuminata* (Schmarda) Stein, l.c., f.43, this form is smooth and broadest below, but it is regularly rounded at the sides, not angular. Also it shows the square neck with everted rim which is characteristic of these tailed varieties of *Trachelomonas*. Schmarda's form has an obliquely sliced-off neck. The figure given by Stein measures 55 \times 32 μ .



Fig.10.

Tr. acuminata
(Schmarda) Stein,
 \times 650, after Stein.

TRACHELOMONAS URCEOLATA Stokes, forma, (Pl. v., f.4),

Forma longior, corpore inferne modice attenuato; collo paullo oblique truncato; cauda paullulo oblique protracta.

Long. 54, lat. 20; coll. alt. 8, lat. 4; caud. long. 15 μ .

Parramatta 136.

Cf. Stokes, Frw. Infus. U. S., p.89, Pl. i., f. 26. This is merely an irregular (probably growing) form of the type. The latter has an oblong body, not tapering to either end, with somewhat flattened sides. Size 44 \times 20, Stokes.



Fig.11.

Tr. urceolata
Stokes,
after Stokes.

Var. OVALIS, n.var. (Pl. v., f.5, 6).

Forma corpore ovali nec oblongo, lateribus rotundatis nec deplanatis; collo brevior, ore modice everso; cauda brevi interdum brevissima.

Long. 34-37, lat. 22; coll. alt. 4-6, lat. 6; caud. long. ad 6 μ .

Parramatta 136, 165, 166.

The tail in this form is only about one-third the usual length, and is sometimes reduced to a mere broad, triangular projection.

Var. *GIRARDIANA*, n.var. (Pl. v., f.7, 8).

Lorica corpore a latere subhexagono, a vertice circulari; lateribus objectis parallelis, planis vel interdum levissime retusis; collo modo brevi, ore obliquo, modo longo recto truncato, ore minute denticulato. Membrana aspera.

Long. 38-57, lat. 22-26; coll. alt. 4-6, lat. 6-8; caud. long. 16 μ .
Lismore 242.

There is some doubt whether this form should be placed under *Tr. urceolata*, as it comes from a different part of the country, and the membrane is distinct. The latter is irregularly and minutely rough, due probably to depressed scrobiculations, as in *Tr. scabra*, supra. Obtained from swampy ground at the foot of Girard's Hill.

TRACHELOMONAS ELEGANTISSIMA (G. S. West) mihi.

Syn. *Dinobryon elegantissimum* G. S. West, Yan Yean Res., p.82, fig.10K; *Trach. caudata* var. *elegantissima* Playf., Sydney Water Supply, p.546.

From the figure of *Tr. caudata* given by Stein in his *Naturgeschichte der Flagellaten*, a copy of which has lately come into my hands, it appears that there are too many points of difference for this form to be conveniently arranged as a variation of *Tr. caudata* (Ehr.) Stein. I have made it, therefore, a separate type. West's dimensions are:—Long. (sine stip.) 34; long. stip. 28; lat. max. 13, lat. coll. 4, lat. oscul. 7.5 μ .



Fig. 12.
Tr. elegantissima (G. S. West),
× 1000, after West.

Var. *OVATA*, nom.nov. (Pl. v., f.9).

Minor quam forma typica, corpore ovato, superne rotundato, inferne acuminato lateribus pæne planis ad stipitem convergentibus; collo quadrato, lateribus parallelis, ore everso.

Long. 38, lat. 9 μ .

Sydney Water screenings.

Syn. *Trach. caudata* var. *elegantissima* Playf., l.c., Pl.57, f.11. The Victorian form, which I have not yet noted here, is somewhat different in shape from mine; I am, therefore, describing the latter as a variation.

TRACHELOMONAS NAPIFORMIS, n.sp. (Pl. v., f.10).

Lorica corpore ovato, fronte rotundato, a tergo acuminato lateribus modice arcuatis; stipite nullo sed cauda brevi instructa; collo quadrato, lateribus parallelis, ore everso. Primum caudâ extremâ affixa, deinde exsoluta.

Long. 34, lat. 18; coll. alt. 8, lat. 6; caud. long. 6 μ .

Parramatta 136.

All these tailed varieties are plankton-forms. *Tr. napiformis* and all others in sample No.136, were obtained from a body of freshwater in Parramatta Park, by passing several gallons of water through filter-paper. Many specimens of this form were noted firmly fixed by the point of the tail, others were swimming free. Syn., *Tr. caudata*, these Proceedings, 1913, Pl.57, f.10.,

Forma.

Forma lateribus ad caudam convergentibus pæne planis; cauda brevissima, triangulari; collo oblique truncato nec ore everso; colore pæne hyalina.

Long. 36, lat. 22; coll. alt. 4, lat. 7 μ .

Botany 151.

Var. *ELEGANS*, n.var. (Pl. v., f.11).

Major quam f. typica, corpore ovato superne valde angulato, lateribus arcuatis, paullo supra caudam quam levissime angulatis, ad caudam convergentibus; collo quadrato lateribus modice retusis, ore everso valde producto; colore dilutissime fulva.

Long. 60 (corp. 40), lat. 30; coll. alt. 8, lat. 8, lat. oris 16; caud. long. 12 μ .

Duck Creek near Clyde.

Several specimens observed in a sample obtained by filtering a considerable volume of water.

TRACHELOMONAS SESSILIS, n.sp. (Pl. v., f.12).

Lorica corpore late-ovato pæne triangulari, superne latissimo, abhinc lateribus rapide ad basin convergentibus, inferne acute-rotundato, cauda nulla; collo longo recto, lateribus parallelis, ore everso; colore dilutissime fulva; primum sessilis.

Long. 26, lat. 20; coll. alt. 8, lat. 6 μ .

Parramatta 136.



Var. *MINIMA*, n.var. (Pl. v., f.13).

Forma minima nec ore everso.

Long. 9, lat. 5μ .

Fairfield.

Noted in a gathering squeezed out of *Myriophyllum* in Orphan School Creek.

Var. *ELEGANS*, n.var. (Pl. v., f.14).

Lorica corpore brevior quam in var. *minima*; collo autem longiore, ore everso valde producto; basi per papillam affixa.

Long. 13, lat. $5\frac{1}{2}\mu$.

Guildford 88.

TRACHELOMONAS TRIQUETRA, n.sp. (Pl. v., f.15).

Lorica corpore superne exacte rectangulari lateribus rectis parallelis, inferne acuminato lateribus planis rapide ad caudam convergentibus; collo recto brevi; cauda brevi; membrana tenui scrobiculata(?). Lorica a vertice triquetra.

Long. 40, lat. 20μ .

Parramatta 136.

Several of this shape seen alive among a great variety of other tailed forms (Parramatta 136). All these plankton-forms of *Trachelomonas* have thin transparent membranes, dull and rather irregular in texture (scrobiculate?) and are all very pale-coloured, pale brown, biscuit or flesh-colour.

TRACHELOMONAS GIBBEROSA, n.sp. (Pl. v., f.16-18).

Lorica inflata rhomboidea, utrinque valde angulata, in medio latissima, lateribus superne ad collum inferne ad caudam rapide convergentibus, pæne rectis; collo plerumque oblique truncato interdum ore everso; cauda acutissima; membrana hyalina vel dilutissime fulva.

Long. 32-56, lat. 16-30; coll. alt. 8, lat. 6-7; caud. long. ad 20μ .

Parramatta 136, 165, 166. Auburn 120.

Almost all the tailed forms of *Trachelomonas* may be found now and again with obliquely truncate necks.

Var. ROTUNDA, n.var. (Pl. v., f.19).

Lorica corpore utrinque inflato, depresso, lateribus æqualiter rotundatis; collo quadrato ore everso; cauda obtusa subito e basi corporis oriente.

Long. 28, lat. 17; coll. alt. 8, lat. 6; caud. long. 10, lat. max. 4 μ .

Parramatta 136.

TRACHELOMONAS SUBGLOBOSA, n.sp. (Pl. v., f.20, 21).

Lorica inæqualiter subglobosa, fronte leviter deplanata, interdum inferne levissime acuminata; collo lato humillimo; membrana interdum scrobiculata, dilutissime fulva.

Long. 22-26, lat. 22; coll. alt. 2, lat. 6-8 μ .

Parramatta 136; Duck Creek near Clyde.

In spite of its obvious likeness to *Tr. oblonga* var. *australica*, this "species" is biologically connected with the tailed forms described above, in company with which the two specimens figured were found. All these forms have a tendency to be slightly irregular in outline, and this may be noted here also. The membrane, too, is similar, and the acuminate character of the hinder end in Fig.20 points in the same direction.

List of Synonyms.

Tr. reticulata Klebs, Organ. ein. Flag., p.320, 1881-85, = *Tr. eurystoma* var. *Klebsii* mihi. The name "*reticulata*" being unsuitable in a variation.

Tr. crenatocollis Maskell, Trans. N. Zeal. Inst., 1886, Pl.3, f.3, = *Tr. hispida* var. *crenatocollis* (Maskell) mihi; cf. Stein, l.c., T.xxii., f.24; Dangeard, Les Eugléniens, p.135, f.41 A.

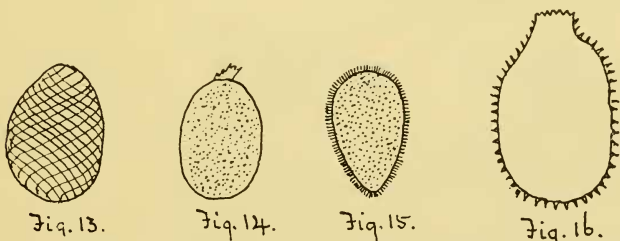


Fig.13.—*Tr. torta* Stokes. Fig.14.—*Tr. euchlora* var. *similis* (Stokes) mihi. Fig.15.—*Tr. eurystoma* var. *Stokesii* mihi. Fig.16.—*Tr. hispida* var. *piscatoris* (Fisher) mihi. All after Stokes.

Tr. torta Kellicott, in Stokes, Infus. U. S., p.87, Pl.1, f.24, 1888 = *Crumenula texta* Duj., = *Euglena viridis* larval form, cf. Stein, T. xx., f.26. Stokes, in his figure, has put in the striæ from both sides of the test; there is only one set of striæ, as shown by Stein. I have often found these empty tests in mixed gatherings.

Tr. piscatoris (Fisher) Stokes, Journ. Trenton Nat. Hist. Soc., 1886; Infus. U. S., p.88, Pl.1, f.25, 1888 (*Laguncula piscatoris* Fisher, Proc. Amer. Soc. Micr., 1880), = *Tr. hispida* var. *piscatoris* (Fisher) mihi.

Tr. cervicula Stokes, Proc. Amer. Phil. Soc., p.75, f.11, 1890, = *Tr. volvocina* var. *cervicula* (Stokes) mihi.

Tr. similis Stokes, *ibid.*, p.76, f.12, = *Tr. euchlora* var. *similis* (Stokes) mihi.

Tr. obovata Stokes, *ibid.*, p.76, f.13 = *Tr. eurystoma* var. *Stokesii* mihi. The name "*obovata*" is unsuitable in the variation, as the type itself and var. *Klebsii*, supra, are both obovate.

Tr. volvocina var. *minuta* Lemm., Bot. Centralblatt, Bd.76, p.152, 1898. Size not known, has probably been included here with the type.

Tr. lagenella Dangeard, Les Eugléniens, p.132, f.40, 1902 (not Ehrenberg nor Stein), = *Tr. ovalis* Playf., Biol. Richm. R., p.141, Pl. viii, f.4; but cf. *Tr. teres* Maskell. The decided neck, generally slanting, is characteristic of *Tr. euchlora* (*lagenella*). Such forms as depicted by Dangeard are just as likely to be smooth forms of *Tr. hispida* (Stein, T. xxii., f.23), or *Tr. armata*, or *Tr. teres* Maskell, without a neck. It is best to keep such forms by themselves where possible.

Forms not yet observed here.

The exact types were not observed of *Tr. euchlora* (*lagenella*) (Ehr.) Lemm., *Tr. armata* (Ehr.) Stein, *Tr. caudata* (Ehr.) Stein, *Tr. acuminata* (Schmarda) Stein, *Tr. bulla* Stein, *Tr. eurystoma* Stein, *Tr. urceolata* Stokes, *Tr. Volzii* Lemm., *Tr. elegantissima* (G. S. West) mihi, but only very similar forms.

Tr. volvocina β *rugulosa* (Stein) Klebs, = *Tr. rugulosa* Stein, l.c., f.12, 13. Cf. Dangeard, l.c., p.128, f.39. A form of *Tr. volvocina* with minute ridges in slanting lines across the surface.

Dangeard's form is so entirely different from Stein's *Tr. rugulosa*, that I propose to make it a distinct variety under the name of *Tr. volvocina* var. *Dangeardii*, nom.nov.

Tr. volvocina γ *hyalina*
Klebs, Organ.ein.Flag., p.319.
The body of the animalcule is devoid of chlorophyll.

Tr. hispida β *cylindrica*
Klebs, l.c.; cf. Dangeard, l.c.,
p.135(no figure). This must
be a smaller form of *Tr. his-*
pida var. *rectangularis* Br.
Schröder, Plöner Berichte, Bd.
v., T.ii., f.8; Stein, T.xxii, f.34.

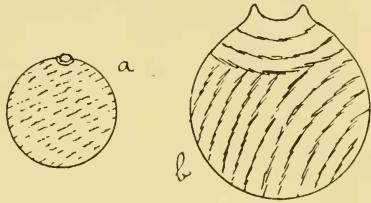


Fig.17.—*Tr. volvocina* β *rugulosa*(Stein)
Klebs. a $\times 650$, after Stein; b, after
Dangeard.

As Dangeard remarks that it is much smaller than the type, the dimensions of which are roughly $30 \times 20 \mu$, it must be quite minute.

Tr. hispida var. *subarmata* Br. Schröder, l.c., p.49, T.1, f.7. A broadly oval form a little larger than the type, with longer spines at each end. Schröder's figure gives dimensions of $37 \times 29 \mu$,

Tr. hispida var. *punctata* Lemm., von Dr. Volz ges. Süswasseralg., p.165, 1904 (no figure). Oval, closely and finely punctate, with a low, straight, truncate neck.



Fig.18.—*Tr. spinosa* Stokes, after Stokes. Fig.19.—*Tr. armata* var.
Steinii Lemm., $\times 650$, after Stein. Fig.20.—*Tr. bulla* var. *regularius*
Lemm., $\times 1000$, after Lemmermann.

Tr. bulla var. *regularius* Lemm., *ibid.*, T.xi., f.6. Long elliptic, $30 \times 14 \mu$, with numerous, very short scattered spines, no neck

I doubt whether this form is best arranged under *Tr. bulla* Stein. The characteristics of the latter are all wanting, viz., the ovate body, long neck, and smooth (or very slightly denticulate) membrane. *Tr. bulla* itself, indeed, is of very doubtful validity, and were it not for the fact that its forms are generally smooth, it would probably before this have been arranged as a tail-less variant of *Tr. caudata*. Lemmermann's form goes best under *Tr. spinosa* Stokes, *infra*; note that in both forms, and in these two only, all the spines point backwards.

Tr. oblonga var. *truncata* Lemm., *ibid.*, T. xi., f. 7, 8; Reise n.d. Pacific, p. 344, 1899. Lorica oblong, 12-13 μ long, 11 μ broad, truncate in front, squarely rounded below, with a short straight truncate neck, membrane smooth.

Tr. acanthostoma Stokes, Infus. U. S., p. 89, no fig., 1888; Proc. Amer. Phil. Soc., 1887. Lorica subspherical, brown, two or more irregular rows of short conical spines round the orifice, no neck, membrane punctate, length 36 μ .

Tr. spinosa Stokes, Proc. Amer. Phil. Soc., 1890, p. 76, f. 14. Lorica oval, $1\frac{1}{3}$ times as long as broad; ends equally and evenly rounded; spines slightly recurved, pointing backwards, longest posteriorly; neck short, smooth, truncate, slightly narrowed above; length 42 μ . The recurved spines, pointing backwards, are characteristic of this type; cf. *Tr. bulla* var. *regularius* Lemm., *supra*.

Tr. teres Maskell, Trans. N. Zeal. Inst., 1887, T. 1, f. 7. Oblong-oval, smooth, with a low broad ring-shaped neck; length 35 μ , breadth about 20 μ . Very like *Tr. lagenella* Dangeard (non Stein), *l.c.*, p. 132, f. 40E, but with a low broad neck.

Tr. armata var. *Steinii* Lemm., see note on *Tr. armata* var. *glabra*, *supra*.

EXPLANATION OF PLATES I.-V.

All figures enlarged 1000 diams., unless otherwise specified.

Plate i.

Fig. 1.—*Trachelomonas volvocina* Ehr.

Fig. 2. ,, ,, var. *punctata*, n. var.

Fig. 3. ,, ,, var. *granulosa*, n. var.

- Fig. 4.—*Trachelomonas volvocina* var. *cervicula* (Stokes) mihi.
 Fig. 5. „ *intermedia* Dangeard.
 Figs. 6-8. „ „ var. *levis*, n. var.
 Fig. 9. „ *Botanica*, n. sp.; ($\times 660$).
 Fig. 10. „ „ var. *minor*, n. var.; ($\times 660$).
 Fig. 11. „ *ovalis* Playf.
 Fig. 12. „ „ var. *minor*, n. var.
 Fig. 13. „ *bullata* var. *australis*, n. var.
 Figs. 14-16. „ *oblonga* Lemm.
 Figs. 17-21. „ „ var. *australis*, n. var.
 Figs. 22, 23. „ „ var. *attenuata*, n. var.; (Fig. 23 $\times 1330$).
 Fig. 24. „ „ var. *scabra*, n. var.
 Fig. 25. „ *pusilla*, n. sp.
 Fig. 26. „ „ var. *rotunda*, n. var.
 Fig. 27. „ „ var. *punctata*, n. var.
 Figs. 28, 29. „ *cylindrica* Ehr.
 Fig. 30. „ „ var. *decollata*, n. var.
 Fig. 31. „ „ var. *punctata*, n. var.
 Figs. 32, 33. „ *pulcherrima*, n. sp.
 Figs. 34, 35. „ „ var. *laticornis*, n. var.
 Fig. 36. „ „ var. *ovalis*, n. var.
 Figs. 37, 38. „ „ var. *minor*, n. var.
 Figs. 39, 40. „ „ var. *Lismorensis*, n. var.
 Fig. 41. „ „ var. *granulosa*, n. var.

Plate ii.

- Fig. 1.—*Trachelomonas Volzii* var. *pellucida*, n. var.
 Fig. 2. „ „ var. *australis*, n. var.
 Fig. 3. „ „ var. *intermedia*, n. var.
 Figs. 4, 5. „ *euchlora* var. *minor*, n. var.
 Fig. 6. „ *ampullula*, n. sp.
 Fig. 7. „ „ var. *major*, n. var.
 Figs. 8, 9. „ *conica*, n. sp.
 Fig. 10. „ „ var. *granulata*, n. var.
 Fig. 11. „ „ var. *Richmondie*, n. var.
 Fig. 12. „ „ var. *ovata*, n. var.
 Figs. 13, 14. „ „ var. *caudata*, n. var.
 Fig. 15. „ *clavata*, n. sp.
 Fig. 16. „ „ var. *subarmata*, n. var.
 Fig. 17. „ *cactacea*, n. sp.
 Fig. 18. „ *granulosa*, n. sp.
 Fig. 19. „ „ var. *subglobosa*, n. var.
 Fig. 20. „ „ var. *oblonga*, n. var.
 Fig. 21. „ *Volzii* var. *cylindracea*, n. var.

Plate iii.

- Fig. 1.—*Trachelomonas euchlora* (Ehr.) Lemm., forma.
 Fig. 2. ,, *australis*, n.sp.
 Fig. 3. ,, ,, var. *obesa*, n.var.
 Fig. 4. ,, ,, var. *splendida*, n.var.; (× 660).
 Fig. 5. ,, ,, var. *arcuata*, n.var.
 Fig. 6. ,, ,, var. *conica*, n.var.
 Fig. 7. ,, ,, var. *subdenticulata*, n.var.
 Fig. 8. ,, *hispida* (Perty) Stein, type.
 Fig. 9. ,, ,, var. *australica*, n.var.
 Fig. 10. ,, ,, var. *rectangularis* Br. Schröder.
 Figs. 11, 12. ,, ,, var. *granulata*, n.var.
 Fig. 13. ,, *bacillifera*, n.sp.; (× 750).
 Fig. 14. ,, ,, var. *ovalis*, n.var.; (× 750).
 Figs. 15, 16. ,, ,, var. *minima*, n.var.; (× 660).
 Fig. 17. ,, *armata* var. *glabra*, n.var.; (× 750).
 Fig. 18. ,, ,, var. *granulata*, n.var.; (× 750).
 Fig. 19. ,, ,, var. *sparsigranosa*, n.var.; (× 750).
 Fig. 20. ,, ,, var. *duplex*, n.var.; (× 660).
 Fig. 21. ,, *Lismorensis* var. *inermis*, n.var.
 Fig. 22. ,, ,, var. *oblonga*, n.var.; (× 850).

Plate iv.

- Fig. 1.—*Trachelomonas verrucosa* Stokes.
 Figs. 2, 3. ,, *scabra*, n.sp.
 Figs. 4-6. ,, ,, var. *longicollis*, n.var.
 Figs. 7, 8. ,, ,, var. *ovata*, n.var.
 Fig. 9. ,, ,, var. *scrobiculata*, n.var.
 Fig. 10. ,, ,, var. *elliptica*, n.var.
 Fig. 11. ,, ,, var. *cordata*, n.var.
 Fig. 12. ,, *eurystoma* Stein, forma.
 Fig. 13. ,, ,, var. *producta* mihi.
 Fig. 14. ,, ,, var. *Klebsii* mihi.
 Figs. 15, 16. ,, *Sydneyensis*, n.sp.
 Fig. 17. ,, ,, var. *oblonga*, n.var.
 Fig. 18. ,, ,, var. *minima*, n.var.
 Fig. 19. ,, ,, var. *obesa*, n.var.
 Fig. 20. ,, *armata* var. *longispina*, n.var.
 Fig. 21. ,, *scabra* var. *pygmæa*, n.var.

Plate v.

- Figs. 1, 2.—*Trachelomonas caudata* var. *australica*, n.var.; (× 660).
 Fig. 3. ,, *acuminata* var. *amphora*, n.var.
 Fig. 4. ,, *urceolata* Stokes, forma.

- Figs. 5, 6.—*Trachelomonas urceolata* var. *ovalis*, n. var.
 Figs. 7, 8. „ „ var. *Girardiana*, n. var.
 Fig. 9. „ *elegantissima* var. *ovata* mihi.
 Fig. 10. „ *napiiformis*, n. sp.
 Fig. 11. „ „ var. *elegans*, n. var.; ($\times 660$).
 Fig. 12. „ *sessilis*, n. sp.
 Fig. 13. „ „ var. *minima*, n. var.; ($\times 2000$).
 Fig. 14. „ „ var. *elegans*, n. var.; ($\times 2000$).
 Fig. 15. „ *triquetra*, n. sp.; *a*, end view.
 Figs. 16-18. „ *gibberosa*, n. sp.
 Fig. 19. „ „ var. *rotunda*, n. var.
 Figs. 20, 21. „ *subglobosa*, n. sp.

